VOLUME 8

UTILITIES

SITE PROPOSAL
SUPERCONDUCTING SUPER COLLIDER

STATE OF
MONTANA

COMANCHE
BASIN

V O L U M E 8

UTILITIES

SITE PROPOSAL

SUPERCONDUCTING SUPER COLLIDER

STATE OF

MONTANA

COMANCHE
BASIN

VOLUME 8

UTILITIES

All utilities are on site or will be provided at the site at comparatively low rates.

Highly reliable 230kV and 500kV transmission is on site with redundant generation sources closeby.

Low-cost power is available at 34 mills/kWhr.

Ample potable water will be provided at the collider ring.

Natural gas, at low rates, will be available at the east and west clusters.

Waste disposal is locally available. Low-level contaminate waste disposal services are available.

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Water Quality Reports, City of Billings, Aug, 1986
Department of Health & Environmental Sciences Report, Dec, 1986
Montana Power Company - Forecast of Electricity and Natural Gas Rates - 1987-1996 - Gas Rate Service
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8.1 POWER

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8.1 POWER

Montana offers an attractive combination of high reliability and low cost service to the SSC. The net generation capacity in Montana is 4,500 MW, of which 2,000 is hydroelectric and 2,500 is coal-fired. The largest single unit in Montana is the Colstrip Generating Station, jointly owned by Montana Power Company (MPC), Pacific Power & Light, Washington Water Power, Puget Sound Power & Light, and Portland General Electric Company. Colstrip comprises two 330 MW units and two 700 MW units for a capacity of 2,060 MW. MPC owns 50 percent of units 1 and 2 and owns or leases under a long-term arrangement 30 percent of units 3 and 4 for a total of 750 MW. In addition, MPC owns two thermal units in Billings, with a capacity of about 250 MW.

Utilities and generating plants by hydroelectric and thermal are listed in Table 8.1-1. Figure 8.1-1 shows the locations and capacities of power plants in Montana.

8.1.1 Regional Generation Capacity

The Comanche Basin is served by MPC, a healthy utility with an excellent balance of hydroelectric and coal-fired generating resources. MPC currently has a system capacity of 1,700 MW comprising 520 MW of hydroelectric and 1000 MW of thermal generation. In addition, it has 180 MW of firm power purchase agreements. In 1986, MPC served a system peak demand of 1,233 MW, 73 percent of its capacity.

MPC is part of the Western Systems Coordinating Council of the North American Electric Reliability Councils. It is intertied to transmission and generation plants owned by the federal government (through the Bonneville Power Administration), Western Area Power Administration, Idaho Power, Pacific Power & Light Company, the Rural Electrification Administration, Washington Water Power Company and Utah Power & Light Company.

These systems are interconnected by two 500 kV transmission lines and a number of 230 kV lines. The Broadview switchyard, 6 miles from the campus area, is the center for the intertie of these 500 kV and 230 kV lines. This switchyard provides optimum reliability to any facility receiving power through it.

MPC itself owns 6,838 miles of transmission lines connecting its coal-fired plants in Colstrip and Billings, and its hydro plants along the Missouri River and other rivers in Western Montana. MPC serves approximately 240,000 electric customers -- 200,000 residential, 37,000 commercial, and 2,200 industrial -- with 72 sales agreements with other utilities. Because of its low generating costs, the average annual cost of electricity for residential users was $405 for 8,566 Kwh of energy in 1986.

In 1986 MPC had a 27 percent reserve beyond peak demand. However, to prepare for future load growth, MPC has studied various capacity increase options, including hydroelectric and coal-fired plants. It has selected sites for both options. The Company will build a 240 MW combined cycle unit at its Mill Creek switchyard in Western Montana if Montana is chosen as the preferred site for the SSC. This type of unit would respond efficiently to future load demands, including the SSC, and could be built more quickly and economically than new large scale hydro or coal-fired stations.

The new Mill Creek unit will be placed at an existing major transmission hub between Butte and Anaconda. This switchyard is a major 230 kW intertie point with Bonneville Power Administration to the west and Idaho and Utah to the south. Lines from this area interconnect with the Broadview switchyard.

8.1.2 Regional Transmission Network

The Montana transmission network is shown on Figure 8.1-2 in the enclosed pocket. Other readily available maps published by the Western Systems Coordinating Council show similar information in the context of the 13-state western region. Figure 8.1-2 shows the geographical relationships of generating sources, the lines connecting them, their voltages and their owners. A diagram of the MPC grid is shown on Figure 8.1-3 in the map folder. A study of this network diagram shows that the Broadview switchyard is fed by two 500 kV transmission lines passing between the 2,060 MW Colstrip generating station and the Garrison switchyard of the Bonneville Power Administration 225 miles to the west. The Broadview switchyard also receives three 230 kV lines connecting Great Falls and Billings. Three 100 kV lines serve towns north of the Broadview area.

Several options are available among transmission lines through which power can be supplied to the SSC. The 500 kV system can provide power from the Pacific Northwest or from Colstrip. In addition, the 230 kV lines provide power from Billings, Great Falls, the new unit proposed at Mill Creek, or from stations in Wyoming, Idaho or Utah. The collider site offers an exceptionally stable and reliable power supply.

TABLE 8.1-1

Existing Electric Power Plants in Montana

Hydro Plants

Utility and Plant	No. of Units	Installed Capacity MW	Peak Capability MW	Average Annual Generation Capability MWh
The Montana Power Company				
Mystic Lake	2	10	11	52,500
Morony	2	45	47	310,000
Ryan	6	48	60	450,000
Cochrane	2	48	50	245,000
Rainbow	8	35.6	36	292,000
Black Eagle	3	16.8	18	156,000
Holter	4	38.4	48	226,000
Hauser Lake	6	17	17	111,000
Madison	4	9	9	50,000
Thompson Falls	6	30	40	310,000
Kerr	3	168	180	1,100,000
Milltown	5	3	3	20,000
Flint Creek	2	1.1	1	8,000
Subtotal		469.9	520	3,330,500
Pacific Power & Light Co				
Big Fork	3	4.2	4.6	31,000
Washington Water Power Co				
Noxon Rapids	4	282.9	430	1,776,000
Noxon Rapids #5	1	70.7	112	0
Montana Light & Power Co				
Lake Creek	2	4.5	5.5	25,000
U.S. Bureau of Indian Affairs				
Big Creek	2	0.4	0.4	2,040
U.S. Bureau of Reclamation				
Yellowtail	4	250	288	910,000
Canyon Ferry	3	50	58	330,000
Fort Peck	5	165	205	960,000
Hungry Horse	4	285	328	843,000
U.S. Corps of Engineers				
Libby	4	420	483	1,717,000
TOTAL - HYDRO State of Montana		2002.6	2434.5	9,924,540

Thermal Plants

Utility and Plant	No. of Units	Nameplate Capacity MW	Net Peak Capability MW	Assumed Annual Energy Capability MWh
The Montana Power Company				
J E Corette	1	172.8	180	1,070,900
F W Bird	1	69	70	459,900
Colstrip #1 and #2	2	358.4	330	2,168,100
Colstrip #3 and #4	2	466.8	420	2,759,400
Montana-Dakota Utilities Co				
Lewis and Clark	1	50	51	335,100
Glendive	1	30.7	41.4	
Miles City GT	1	23.3	28	184,000
Pacific Power & Light Co				
Libby GT	1	23.8	26	170,800
Colstrip #3 and #4	2	155.6	140	919,800
Washington Water Power Co				
Colstrip #3 and #4	2	233.4	210	1,379,700
Montana Light and Power Co				
Troy	1	3	3.2	21,000
Libby	3	13.3	14.5	95,200
Puget Sound Power & Light Co				
Colstrip #1 and #2	2	358.4	330	2,168,100
Colstrip #3 and #4	2	389.0	350	2,299,500
Portland General Electric Co				
Colstrip #3 and #4	2	155.6	140	919,800
TOTAL - THERMAL State of Montana		2503.1	2334.1	14,951,300

Power easily can be provided to the site with the addition of short 230 kV lines from the Broadview switchyard to power distribution substations at the east and west clusters. These two lines will be synchronized 230 kV lines from the 230 kV portion of the switchyard; thus, accomodating the requirement for a "make before break" capability. The proposed 230 kV facilities will be designed with a redundant "breaker and one half" arrangement that provides for continuous service to the SSC should a single line failure occur.

On Figure 8.1-4, a "breaker-and-one-half" system is tied to the three incoming 230 kV lines from Billings and Great Falls. Figure 8.1-5 shows the two new feeder lines to the cluster areas.

8.1.3 Stability and Reliability of the Network

The Broadview switchyard interconnects seven transmission lines with voltages of 230 kV or higher, any one of which has the capacity to provide full load service to the SSC. The primary purpose of the station is to provide a connection from the 500 kV Colstrip transmission lines to the Billings area to serve loads of MPC. This switchyard provides an added benefit in increasing substantially the stability of the Colstrip generating complex by reducing the impedance change resulting from the loss of a line for any reason.

The service at the Broadview switchyard is as reliable or better than that of any major transmission bus in the Rocky Mountain states. The basic bus design is the so-called "breaker-and-one-half" scheme for both the 500 kV and the 230 kV buses. With two 600 MVA auto-transformers between the 500 kV and 230 kV buses, there is adequate transformer capacity to meet electrical load requirements of the SSC. The logical method to connect the SSC would use two synchronized 230 kV lines originating from the Broadview switchyard, one to each of the east-cluster and west cluster switchyards. The existing switchyard design allows for additional lines to be added. Two lines would require three 230 kV circuit breakers to follow consistently the "breaker-and-one-half" scheme shown in Figure 8.1-4.

The high reliability of the Broadview 230 kV bus was demonstrated during a major breakup of the western system that occurred February 12, 1985. In this event, power to tens of thousands of customers was interrupted. In Montana, 374 MW of customer load was shed. However, the Broadview switchyard still had retained power through the system failure.

MPC has a design to control transmission system stability whose primary objective is to retain the interconnection between Montana and the Northwest for any credible contingency. Systems are in place to perform this task while preventing the voltage at any load bus from dipping below 80 percent of the pre-event voltage level except during faults. Thus, there is a high probability that in the aftermath of any event, the Broadview bus will be connected by at least one 500 kV line to the Pacific Northwest. Thus, the large hydroelectric capacity of stations such as Coulee Dam will be available to meet emergency reserve requirements. If this path were severed, the two lines to the east are connected directly to the Colstrip station, which would have surplus capacity under those circumstances.

The other three lines connected at Broadview are 230 kV lines. One connects Broadview to 210 MW of hydropower in Great Falls plus other generating plants belonging to MPC and the U.S. Bureau of Reclamation (USBR). These units have a combined capacity of 317 MW. The other two 230 kV lines connect the Broadview station to the greater Billings area. One of these ties directly to the coal-fired Corette unit rated at 180 MW, and the 70MW Bird unit. Billings is the interconnection point to the Pacific Power and Light system in Wyoming and to USBR's. There is a 288 MW Yellowtail hydroelectric plant approximately 41 miles south of Billings. The second 230 kV line into the greater Billings area also connects to major transmission lines to the west, including Mill Creek.

About half the generating capacity in Montana is hydroelectric, which inherently provides for a more rapid recovery in the unlikely event of a system blackout.

The stability of the transmission system is inextricably linked to the stability of the Colstrip generating facility. With all four units on line, Montana is a net exporter of power. In fact, the net capacity of the station is roughly 1.5 times as great as the 1986 peak generation of MPC. There are, of course, other entities with load responsibility in Montana, but with full generation at Colstrip, the area could easily be exporting as much as 1500 MW.

A system disturbance in Montana would most likely cause Colstrip to accelerate and then either pull out of step or oscillate as it regains synchronism at a more advanced relative phase angle. The system is designed to maintain these units in step. In situations where this is impossible, such as the simultaneous loss of both 500 kV lines, MPC has automatic controlled unit dropping at Colstrip to preserve as much of the generation as possible while preventing voltage swings below 80 percent of the steady-state bus voltage on any load bus.

This unit-dropping scheme protects all loads in Montana from extreme voltage swings lasting longer than the normal fault clearing times. It also provides stable performance that is far superior to that of any other utility's. No other utility is known to have such a device.

8.1.4 Utility Rate Schedules

MPC proposes to negotiate a long-term power sales agreement for the power requirements of the SSC. Based on the addition of a 240 MW combined-cycle unit and a combination of utility ownership and other financing arrangements, the estimated cost of energy delivered to the SSC site is 34 mills/kWh in 1987 dollars. Actual demand and energy charges will be determined at the time the power contract is executed. It should be noted that fuel and other cost increases in the period to 1996 could affect the cited power costs.

The cost of energy is competitive and should be among the lowest of states submitting proposals for the SSC. A comparison of representative power costs for selected cities, based on published 1985 data, shown on Figure 8.1-6, demonstrates that there will be significantly lower power operating costs for the Montana site.

8.1.5 Future Power Demand and Cost Projection

The current projection for future power demand is given in Table 8.1-2. The expected load growth without the SSC is about 1.8 percent per year over the next 9 years; the projection increases by approximately 17 MW average per year when the impact of the SSC is taken into account. This 17 MW/year increase is the result of increased population and employment, and does not include the power requirements of the SSC facility itself.

The assumptions in calculating the increased demand are:

- 4500 maximum construction employees
- 2500 permanent employees
- 240 MW plant constructed to supply electrical needs of the SSC (at the costs shown in Section 8.1.4).
- Estimated population increase of 10,000 within the MPC service area.

These impacts and the addition of the plant at Mill Creek may result in a rate increase (spread over all classes of customers) of approximately 2 percent. It will be noted that Colstrip Unit 4 is not shown in Table 8.1-2. This unit is being operated but is not rate-based by the Montana Public Utilities Commission. Power taken from the unit is considered "purchased" power. The current output of the plant is used for power sales to other utilities.

For more details about rate projections see Appendix 8A, "The Montana Power Company Forecast of Electricity and Natural Gas Rates 1987 - 1996," a report presented to the Montana Public Service Commission, April 1987.

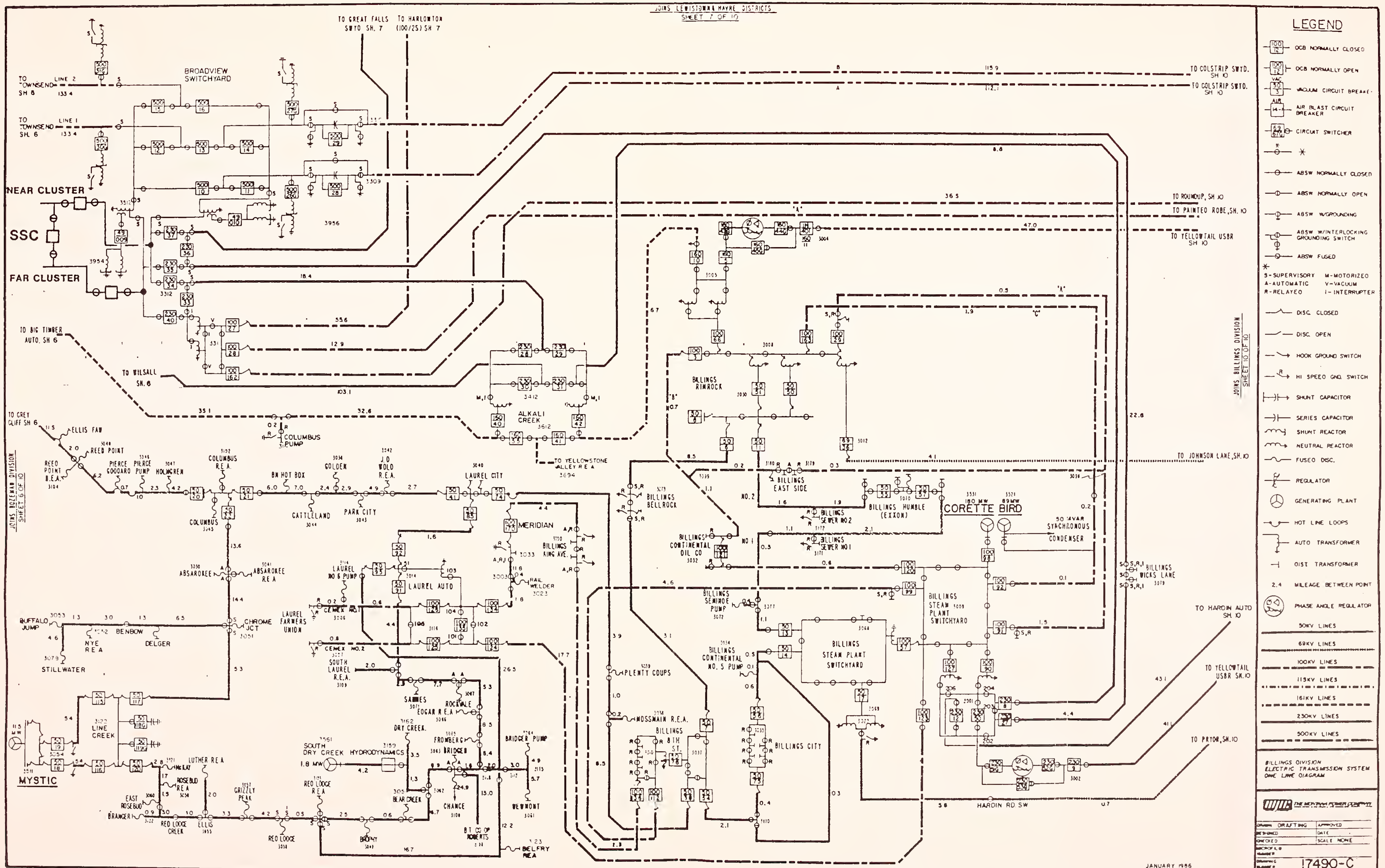
TABLE 8.1-2 Current Projection of Electrical Demand

THE MONTANA POWER COMPANY
ENERGY - AVERAGE MW, Base Case

YEAR:	86-87	87-88	88-89	89-90	90-91	91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-00	00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10
ENERGY LOAD:	874	905	919	929	939	952	963	973	987	1002	1018	1032	1041	1050	1065	1074	1083	1098	1113	1125	1137	1150	1163	1176
ENERGY RESOURCES(1)																								
Hydro, critical	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
Corette	119	119	114	119	119	119	114	119	119	119	114	119	119	119	114	119	119	119	32	0	0	0	0	0
Colstrip 1	124	129	124	129	124	129	124	129	124	129	124	129	124	129	124	129	124	129	124	129	124	129	124	129
Colstrip 2	129	124	129	124	129	124	129	124	129	124	129	124	129	124	129	124	129	124	129	124	129	124	129	124
Colstrip 3	165	150	165	150	161	165	150	165	150	161	165	150	165	150	161	165	150	165	150	161	165	150	165	150
Milltown upgrade	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Bird	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0
Stauffer	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
MR1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BPA(FK/EN exchange)	-29	-29	-29	-29	-29	-29	-29	-29	-29	-29	-29	-29	-29	-29	-29	0	0	0	0	0	0	0	0	0
WNP # 1	68	68	68	68	65	65	65	65	65	65	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	914	899	910	902	910	914	894	914	899	910	844	834	849	834	840	878	863	878	774	753	757	742	757	742
SURPLUS(DEFICIENCY):	40	-6	-9	-27	-29	-38	-69	-59	-88	-92	-174	-198	-192	-216	-225	-196	-220	-220	-339	-372	-380	-408	-406	-434
QF resource	2	11	43	78	88	88	97	115	131	139	146	153	160	167	174	182	188	196	207	220	230	239	246	254
SURPLUS(DEFICIENCY):	42	5	34	51	59	50	28	56	43	47	-28	-45	-32	-49	-51	-14	-32	-24	-132	-152	-150	-169	-160	-180
TENTATIVE RESOURCES(1)																								
Pro.Conservation(2)	1	2	4	7	10	13	18	23	32	41	52	63	63	63	63	63	63	63	63	63	63	63	63	63
Acquired energy(3)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	69	89	87	106	97	117
Acquired peak(3)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	1	2	4	7	10	13	18	23	32	41	52	63	63	63	63	63	63	63	132	152	150	169	160	180
SURPLUS(DEFICIENCY): OVER CRITICAL WATER	43	7	38	58	69	63	46	79	75	88	24	18	31	14	12	49	31	39	0	0	0	0	0	0

NOTES:
1. Net of maintenance.
2. Total programmatic conservation estimates are taken from the ECP plan and the Street Lighting conservation program.
3. In the event purchase power is not available, hydro upgrades and development may eventually be considered as a partial replacement of purchased resources and could include upgrades at Kerr, Thompson Falls, and development at Hebgen.
4. Media, water adder.

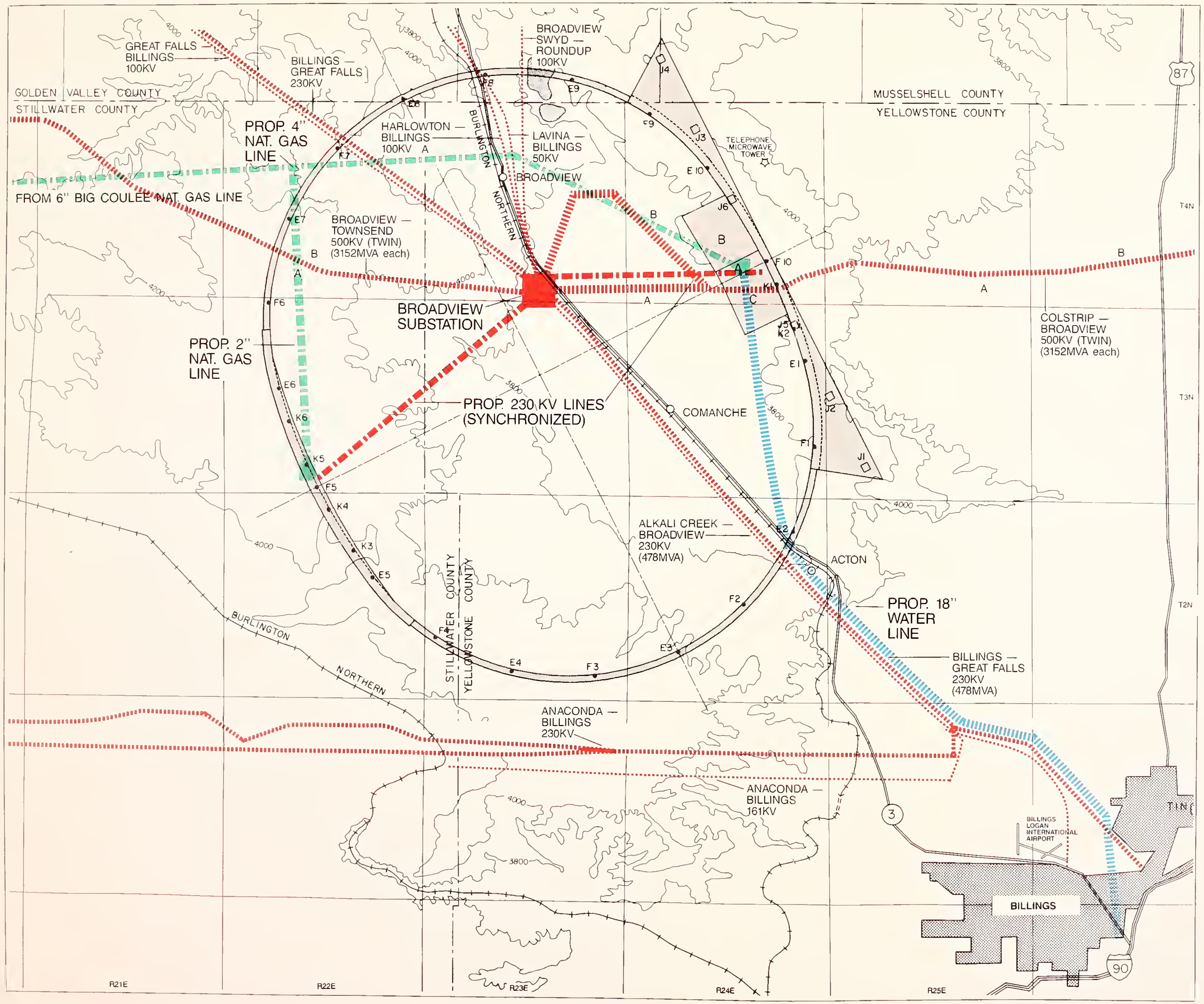
	86-87	87-88	88-89	89-90	90-91	91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-00	00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10
existing	67	67	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68
future	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



STATE OF MONTANA 9/2/87

Figure 8.1-4
SSC TIE IN TO BROADVIEW STATION

Figure 8.1-5 SITE UTILITIES



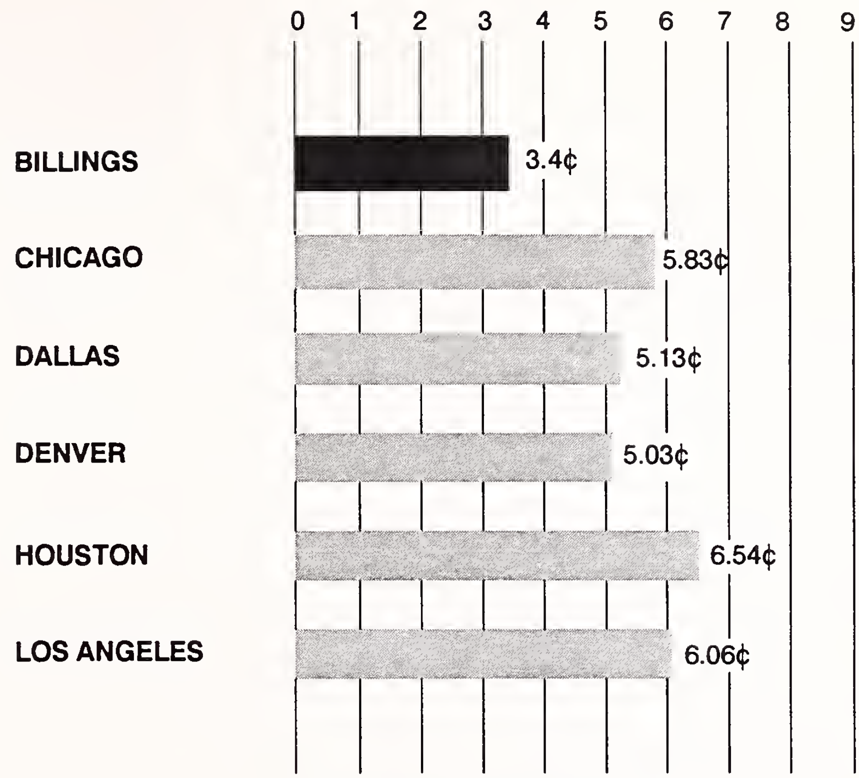
LEGEND

EXISTING AND PROPOSED POWER LINES

PROPOSED NATURAL GAS LINES

PROPOSED WATER LINE

Figure 8.1-6 ELECTRIC RATE COMPARISON



INDUSTRIAL RATE. 200,000 Kilowatthours at 500-Kilowatt demand. (Cents per kWh)

Source: Electric Power Annual 1985, Energy Information Administration, U.S. Department of Energy. Montana Power Company.

8.2 INDUSTRIAL COOLING WATER

8.2 INDUSTRIAL COOLING WATER

The proposed source of industrial cooling water is a new 18-inch pipeline from the Billings city water service to the southeast perimeter of the collider property. The pipeline will deliver 2,600 gpm of potable water. The pipeline and pumping stations will be constructed and paid for by a Rural Special Improvement District.

8.2.1 Available Water Sources

Three water sources were investigated:

- groundwater
- Yellowstone River water
- Billings city water

Groundwater is available in the Comanche Basin in several formations for several hundreds of feet deep. In addition, the Madison formation is found between 6,000 and 8,000 feet deep. The upper aquifers are suitable for domestic use and to supply water for stock ponds. At flows of only 15 gpm, these aquifers are not suitable to supply the SSC except as isolated water sources. The town of Broadview receives well water from an aquifer slightly deeper than local farm wells and obtains a yield of only 80 gpm.

Geological investigations concluded groundwater would not be a concern in tunnel construction because of the low permeability of the upper formations and because water in the basin comes only from the recharge of approximately 13 inches of annual precipitation.

One land owner reported that when an exploratory gas well drilled on his property (Campus expansion area C) a number of years ago encountered water in the Madison formation, the force caused the well casing nearly to come out of the ground. This well was not developed because of the cost and because there was no need for large quantities of water. While there is a significant quantity of water available in the Madison formation, probably more than enough to supply the SSC requirements, the water is believed to be non-potable (Bergantino, et al., 1985). This option could not be offered to DOE without further exploratory drilling.

Water can be provided through a new pipeline to the site either from the existing Billings water supply or from a new intake from the Yellowstone River. A new, independent source from the river will require acquisition of water rights, construction of an intake and additional permitting. Since the site is no closer to the river than to the Billings supply, it is far more reasonable to use the existing Billings supply as the preferred option. The pipeline can be constructed early enough in the design phase of the project to be available by the start of construction.

Based on these considerations, water supplied by the city of Billings through a new pipeline is the option selected for the SSC. The city has more than adequate treatment and supply capacity, and the quality of the water will be excellent. Further demineralization for boiler quality water may be necessary at the site; however, additional treatment should be minimal because the water already is potable.

The water supply system from Billings to the site will be provided through a Rural Special Improvement District. The resolution by the city of Billings authorizing the special district is included in Appendix 4B.

8.2.2 Estimated Cost of Delivered Water

The estimated cost for delivering water to the collider ring boundary near access point E2 will be $1,263 per million gallons. Further distribution of the water system beyond the terminating point will be at DOE expense. From a distribution system around the ring the estimated cost would be $2,000 per million gallons. This cost is based on the current Billings heavy industrial rate of $491.03 per million gals plus the estimated cost of $771.97 for the construction of 16 miles of new pipe line, based on 3 percent financing, 25 year amortization and 1,500 gpm average consumption. The cost also includes operation and maintenance and other indirects associated with the pipe line extension. A planned routing of the water line is shown on Figure 8.1-5. The routing of the water line to the campus area follows the planned main access road shown on Figure 3.1-3 in the map folder. This is the hypothetical shortest distance route to the campus from the termination point to which the Special Rural Improvement District would supply a pipe line.

8.2.3 Water Properties

The most recent analysis of Billings city water was done by the State of Montana in August 1986. The water is in compliance with the National Interim Primary Drinking Water Regulations, as set by the Safe Drinking Water Act. This analysis is summarized in Table 8.2-1 below:

Table 8.2-1

Analysis of Billings City Water

Constituent	mg/l
Calcium (Ca)	28.0
Magnesium (Mg)	9.8
Sodium (Na)	18.4
Potassium (K)	-
Bicarbonate (HCO_3)	97.6
Carbonate (CO_3)	0.0
Chloride (Cl)	-
Sulfate (SO_4)	54
Fluoride (F)	0.38
Phosphate (PO_4 as P)	-
NO_3 + NO_2 (Total as N)	0.04

For a detailed analysis of Billings city water based on samples taken August 1986, refer to two items in the Appendix:

- Water Treatment Plant Process Report - 1985-1986 (pp. 22-23)

This is a summary of the data collected for water discharged from the treatment plant from July 1985 through June 1986.

- Department of Health and Environmental Sciences Report, December 3, 1986

This report summarizes the chemical analysis of Billing's drinking water by the state laboratory in Helena. The data in Table 8.2-1 is from this report.

8.2.4 Evaporative Cooling

The cool, dry climate of Montana lends itself well to effective evaporative cooling, which is likely to be used for heat rejection. Evaporative cooling is related to the wet bulb temperature, specified by the Conceptual Design Report as 78°F. A comparable design temperature at the Montana site would be approximately 66°F. Assuming 85°F water, 30°F temperature rise of the water, and 100 MW of thermal duty, the cooling towers at the Montana site would be 40 percent smaller, with costs proportionately less than for the 78°F design condition. Other advantages would be reduced annual costs of pumping power, fan power, and maintenance.

8.3 POTABLE WATER

8.3 POTABLE WATER

8.3.1 Available Sources

Potable water will be provided through the new pipeline from the Billings city water system. This pipeline will provide industrial cooling water, as described in Section 8.2.

For remote stations along the collider ring, it would be possible to drill shallow wells with expected yields of 15-60 gpm (Bergantino, et al., 1985). However, it may be more cost effective and reliable to install a water distribution pipeline system within, or near, the collider tunnel itself, in which case city water will be available in required quantities at any location.

8.3.2 Cost of Potable Water

Because it is from the same source, the cost of potable water will be the same as the cost of industrial water, as described in Section 8.2.2. Projected costs can be expected to follow the Consumer Price Index.

8.4 FUEL

8.4 FUEL

8.4.1 Fuel Requirements

Fuel for the SSC will be provided from a new natural gas pipeline from the MPC system, shown in Figure 8.1-5. A new 4-inch branch line off the existing 6-inch Big Coulee line will be run to Broadview. A 2-inch branch line will be run from the 4-inch line south to a pressure reducing/metering station at the west cluster. A 4-inch line will be run from Broadview to the east cluster.

MPC has adequate long-term gas supplied to meet the calculated natural gas requirement of approximately 313 MMcf/year for the SSC facility. Reserves, either owned by MPC or controlled under purchase contracts, at January 1, 1987, were 467 Bcf at 15.025 psia. Based on a total system requirement of 29.8 Bcf/year, MPC's gas reserve life index is 15.8 years. MPC's gas transmission system is connected to the Nova pipeline system in Alberta and the Williston Basin interstate system. From these connections, additional gas supplies are available to MPC from Alberta and Williston Basin.

8.4.2 Cost of Fuel

MPC is moving toward fully cost-based rates for natural gas. The price of natural gas to the SSC in cost-based, 1987 dollars is estimated to be $2.63 per MMBtu at 14.9 psia.

This price reflects the current rate for large contract loads (see Appendix 8A, Rate Schedule IIGC-82, Supplement #8) adjusted to the fully cost-based rate contemplated in a cost-of-service rate filing which MPC is preparing to submit soon. Although MPC is submitting the filing with a moderated cost approach, the assumption here is that by the time the SSC is in operation, the rate should be nearly cost-based, under the cost definitions submitted by MPC in this filing.

8.5 WASTE AND SEWAGE DISPOSAL

8.5 WASTE AND SEWAGE DISPOSAL

8.5.1 Available Sewage Treatment Facilities

There are no adequate sewage treatment facilities near the campus. A "greenfield" treatment plant will probably have to be constructed to serve the SSC. Effluent from the sewage treatment plant will be combined with cooling tower blowdown water and ponded for evaporation. The estimated area of the pond for the total site is 280 acres and could be located at any of several sites near the campus for optimum operation and cost.

8.5.2 Solid Waste Disposal Resources

The City of Billings operates a solid waste dump 2 miles south of the city. This dump currently has adequate capacity to serve the city and the SSC facility through the year 2010. Contractor-operated waste disposal trucks will haul material to the dump.

Hazardous waste can be transported to the licensed treatment facilities in Denver or Salt Lake City by licensed carriers such as Special Resource Management, Inc. (SRM), a subsidiary of MPC. SRM, with offices in Billings, operates a five-state fleet of fully licensed hazardous waste vehicles with highly trained and experienced drivers.

REFERENCES

REFERENCES

Bergantino, R.N., Sholes, B. C., and J. Schofield. "Expected Yield in GPM for wells in Montana," MBMG Open-file Report #155, Montana Bureau of Mines and Geology, Butte, Montana, 1985.

Montana Power Company. "Projections of Electric Loads and Resources 1987 - 2010," Butte, Montana, April 1987.

APPENDIX 8A

WATER QUALITY REPORT

CITY OF BILLINGS

AUGUST 1986

LABORATORY SUMMARY (WATER QUALITY)

INORGANICS (CON'T)	AVG	MAX	MIN
YELLOWSTONE RIVER			
NITROGEN AMMONIA	<.07	0.15	<.07
NITROGEN ORGANIC	0.38	1.14	0.04
NITROGEN TKN	0.58	1.96	<.40
NITROGEN NITRATE	0.27	0.61	0.05
NITROGEN NITRITE	<.01	0.01	<.01
SULFATE	65.96	111.60	14.20
SILICA	14.12	18.00	9.80
PHOSPHORUS TOTAL	0.05	0.19	<.02
PHOSPHORUS ORTHO	0.02	0.07	<.02
ORGANICS (mg/l)			
COD	11	19	<1
BOD	1	2	1
TOC			

LABORATORY SUMMARY (WATER QUALITY)

PLANT EFFLUENT	MCL	AVG	MAX	MIN
PHYSICAL PRORERTIES				
pH (su)	6.6-9.0	7.48	7.86	6.59
SP CONDUCTANCE (umhos)	<600	387	568	158
TEMPERATURE (F)		50	75	32
TURBIDITY (ntu)	<.2	0.14	0.51	0.04
COLOR	0	0	0	0
TOTAL HARDNESS (mg/l)		148.04	243.00	52.20
SOLIDS (mg/l)				
TSS		<1	3	<1
TS		234	334	106
TDS		243	344	86
ALUMINUM	<.05	0.07	0.25	<.05
MAGNESIUM		13.45	23.10	4.90
MANGANESE	<.05	<.05	0.07	<.05
COPPER	<1			
IRON	<0.3	<.025	0.050	<.025
POTASSIUM				
SODIUM	<30	13.0		
INORGANIC NON METALS (mg/l)				
ACIDITY				
CHLORIDE	<250	7.72	9.45	3.50
FLUORIDE	<2.4	0.63	0.90	0.26
NITROGEN AMMONIA	<0.5	<.07	0.11	<.07
NITROGEN ORGANIC		0.40	0.86	0.14
NITROGEN TKN		<1.00	1.51	<1.00
NITROGEN NITRATE	<10	0.25	0.59	0.05
NITROGEN NITRITE		<.01	<.01	<.01

WATER TREATMENT PLANT
PROCESS REPORT
1985-1986

LABORATORY SUMMARY (WATER QUALITY)

INORGANICS (CON'T)	MCL	AVG	MAX	MIN
PLANT EFFLUENT				
SULFATE	<250	81.40	126.00	44.20
SILICA		13.78	17.00	11.50
PHOSPHORUS TOTAL		0.07	0.11	<.02
PHOSPHORUS ORTHO		<.02	<.02	<.02
ORGANICS (mg/l)				
COD		< 1	< 1	< 1
BOD		< 1	< 1	< 1
TOC				

BACTERIOLOGY RECORD

	TOTAL
TOTAL COLIFORM	
NO. OF TEST PERFORMED	
RIVER	65
TAILRACE	29
INF FILTER	84
PLANT EFFLUENT	67
DISTRIBUTION	1230
NO. SAMPLES POSITIVE	
PLANT EFFLUENT	
DISTRIBUTION	13
% POSITIVE	1
STANDARD PLATE COUNT	
NO. OF TEST PERFORMED	
RIVER	61
TAILRACE	30
INF FILTER	59
PLANT EFFLUENT	62
DISTRIBUTION	1211
NO. SAMPLES POSITIVE	
PLANT EFFLUENT	
DISTRIBUTION	664
% POSITIVE	52
FECAL COLIFORMS	
NO. OF TEST PERFORMED	
RIVER	4
TAILRACE	4
INF FILTER	3
PLANT EFFLUENT	3
DISTRIBUTION	0
NO. SAMPLES POSITIVE	
PLANT EFFLUENT	
DISTRIBUTION	
% POSITIVE	0

DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES

REPORT DATED DECEMBER 3, 1986

DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
BILLINGS REGIONAL OFFICE

TED SCHWINDEN, GOVERNOR

STATE OF MONTANA

AIR QUALITY BUREAU (406) 248-3266
WATER QUALITY BUREAU (406) 252-5697
FOOD & CONSUMER SAFETY BUREAU (406) [illegible]

For Joe

RECEIVED
DEC 4 1986
BILLINGS WATER &
WASTEWATER DEPTS.

Mr. Alan Tandy, City Administrator
City of Billings
P.O. Box 1178
Billings, MT. 59103

December 3, 1986

Re: Chemical analysis of the water supply for the City of Billings

Dear Mr. Tandy:

Attached is a copy of a chemical analysis for the water supply for Billings. Also included is an explanation of the results of the chemical analysis. This sample was collected on August 5, 1986, and was analyzed by the Montana Department of Health and Environmental Sciences Laboratory in Helena. Such samples are required by the Federal Safe Drinking Water Act, which established standards on certain constituents in a water that all public water supplies must meet. These standards were set because of health related effects. This analysis is required on a yearly basis for inorganic chemicals (minerals) and every three years for organic chemicals (pesticides) for all supplies that are obtained from a surface water.

The results of this chemical analysis indicate that the water supply is in compliance with the National Interim Primary Drinking Water Regulations, as set by the Safe Drinking Water Act.

This analysis pertains to chemicals in the water only, and has no significance as far as possible bacterial presence is concerned.

If you have any questions concerning this analysis or the Safe Drinking Water Act, please call me at 252-5697.

Sincerely,

K J Miller

Kathy J. Miller
Environmental Engineer
Water Quality Bureau
Billings Regional Office

Attachments

cc Gerald Underwood, Dirctor of Public Utilities, P.O. Box 1178, Billings
George F. Sheckleton, M.D., Yellowstone Co. Health Officer, P.O. Box 35033, Billings
File

STATE HEALTH DEPT.   WATER QUALITY BUREAU   HELENA, MONTANA 59620

STATE	MONTANA	COUNTY	YELLOWSTONE
LAT.-LONG.		SAMPLE LOCATION	1 S 26E 2 DB
STATION CODE	0153	ANALYSIS NUMBER	86W1887
DATE SAMPLED	08-05-86	DRAINAGE BASIN	043Q -M.YELLSTNE
TIME SAMPLED	1530	WATER FLOW RATE	
METHOD SAMPLED	GRAB	FLOW MEASUREMENT METHOD	
SAMPLE SOURCE		ALTITUDE OF LAND SURFACE	
WATER USE	PUBLIC SPLY	TOTAL WELL DEPTH BELOW LS	
AQUIFER(S)		SWL ABOVE(+) OR BELOW LS	
SAMPLED BY	WQBB	SAMPLE DEPTH BELOW SURFACE	

SAMPLING SITE: 3304 2ND AVE N BILLINGS MT

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	28.0	1.397	BICARBONATE(HCO3)	97.6	1.600
MAGNESIUM (MG)	9.8	0.806	CARBONATE (CO3)	0.0	0.000
SODIUM (NA)	18.4	0.800	CHLORIDE (CL)		
POTASSIUM (K)			SULFATE (SO4)	54	1.124
			FLUORIDE (F)	.38	0.020
			PHOSPHATE(PO4 AS P)		
			NO3+NO2 (TOT AS N)	.04	0.003
SUM CATIONS	56.2	3.004	SUM ANIONS	152.0	2.747

LABORATORY PH	7.87	TOT HARDNESS(MG/L-CACO3)	110
FIELD WATER TEMPERATURE (C)		TOT ALKALINITY(MG/L-CACO3)	80
SUM-DISS. IONS MEAS.(MG/L)		LABORATORY TURBIDITY (NTU)	
LAB CONDUCTIVITY-UMHOS-25C	305	SODIUM ADSORPTION RATIO	0.8

A D D I T I O N A L   P A R A M E T E R S

ARSENIC,TR (MG/L AS AS)	.001	CADMIUM, TR (MG/L AS CD)	<.001
LEAD,TR (MG/L AS PB)	<.005	MERCURY, TR (MG/L AS HG)	<.0002
SELENIUM,TR (MG/L AS SE)	<.002	CHROMIUM,TR (MG/L AS CR)	<.005
SILVER, TR (MG/L AS AG)	<.01	IRON,TR (MG/L AS FE)	<.01
MANGANESE,TR(MG/L AS MN)	<.005	BARIUM, TR (MG/L AS BA)	.03

REMARKS: DRINKING WATER PROGRAM BILLINGS PUBLIC UTILITIES P020950 BI
LLINGS MT 59111

NOTES: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS/L UG/L=MICROGRAMS/L
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED. TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M=METERS

- -

SAMPLE NO-   SAMPLER-KJM   HANDLING-   ANALYST-LAB   LAB-   SCAN-NO
COMPLETED-09/24/86   COMPUTER RUN-10/09/86   DATA-0684/PGN-0984   FUND-

	CA	MG	NA	K	CL	SO4	HCO3	CO3	NO3
STND DEV. ION BALANCE=									
MPDES-	46.5	26.8	26.6	0.0	0.0	41.3	58.7	0.0	0.0

CALC. MEQ/L= 2.942 TO 3.251

86W1887

Explanation of Chemical Analysis
for Billings

The figures on the chemical analysis sheet are in milligrams per liter (MG/L) or micrograms per liter (UG/L). Milligrams per liter are equivalent to parts per million, and can be converted to grains per gallon by dividing by 17.1. Micrograms per liter are equivalent to parts per billion.

The constituents included in the primary drinking water regulations of the Safe Drinking Water Act, their maximum contaminant levels (MCL), and the constituent concentrations found in the sample are listed in the table below. With the exception of nitrates, the MCLs established for these substances are based on their threat to health when the water is consumed over a long period of time. High nitrate levels pose an immediate threat to infants under six months of age because they may lead to a blood poisoning known as methemoglobinemia.

Primary Drinking Water Standards

	Constituent	MCL	Sample Concentration
Inorganic Chemicals:	Arsenic	0.05 MG/L	.001 MG/L
	Barium	1.	.03
	Cadmium	0.010	.001
	Chromium	0.05	<.005
	Fluoride	~~2.4~~ 4.0	.38
	Lead	0.05	<.005
	Mercury	0.002	<.0002
	Nitrate (as N)	10.	.04
	Selenium	0.01	<.002
	Silver	0.05	<.01
Organic Chemicals: (not required for groundwater supplies)	Endrin	0.2 UG/L	______ UG/L
	Lindane	4.	______
	Methoxychlor	100.	______
	Toxaphene	5.	______
	2,4D	100.	______
	2,4,5-D (Silvex)	10.	______

Other constituents listed in the chemical analysis that may be of special interest are sodium, chloride, sulfate, alkalinity, summation of dissolved ions (total dissolved solids), hardness, iron, and manganese.

Sodium - Large amounts give a salty taste when combined with chloride. Moderate quantities have little effect on the usefulness of water for most purposes. Too much sodium may make the water undesirable for irrigation. Over a period of years sodium builds up in the soil causing deterioration of the soil structure and limiting the soil's ability to support plant growth. The tendency for buildup is affected by the amount of sodium and also the ratio of sodium to other ions in solution. This water has a low sodium hazard from the standpoint of irrigation.

The sodium (Na) concentration of this water is 18.4 milligrams per liter. This may be of interest to persons on sodium restricted diets. Sodium restricted diets are essential in treating congestive cardiac failure, hypertension, renal disease, cirrhosis of the liver, toxemias of pregnancy, and Meniere's disease. It is therefore recommended that health officers, physicians, and consumers be informed of the sodium content.

Continued

The Montana Power Company Forecast of Electricity and Natural Gas Rates 1987 - 1996

Presented to
The Montana
Public Service
Commission

April 1987

MONTANA POWER COMPANY mpc GENERAL OFFICES: 40 EAST BROADWAY, BUTTE, MONTANA 59701 • TELEPHONE (406) 723-5421

April 24, 1987

Mr. Daniel D. Elliott
Administrator
Utility Division
Montana Public Service
  Commission
2701 Prospect
Helena, MT 59620

Dear Mr. Elliott:

RE: Ten-Year Rate Forecast

Enclosed are ten (10) copies of The Montana Power Company's (MPC) 1987 Ten-Year Rate Forecast of its electricity and natural gas rates.

MPC continues to confront the consequences of ever-changing business cycles. With this thought in mind, the forecast reflects the current cost trends which MPC feels most likely will occur and their effects on rates if these cost projections should take place.

Over the last year, the electric utility has seen the implementation of the Rate Moderation Plan which necessarily caused rates to increase. MPC recognizes the impact of rate increases on its customers and remains committed to cost controls which will assist rate stability.

In the natural gas utility, largely due to lower gas supply prices from Canada and the gas tracking mechanism, the rates have continued to fall. Future Canadian gas policy and forthcoming additions to rate base may necessarily provide rate changes in the future.

75th MONTANA POWER COMPANY mpc 1912 ANNIVERSARY 1987

Key Future Milestones - Electric Utility

- Completion of the Rate Moderation Plan, in which three increases are to be followed by three decreases.
- Acceptance and implementation of the Qualifying Facilities (QF) cost tracking mechanism. Based on current on-line dates of signed contracts, the first two increases on an annual basis are projected to be .3 percent and 4.5 percent, respectively.
- The filing and resulting order of an Allocated Cost of Service and Rate Design filing.

Key Future Milestones - Gas Utility

- The filing and resulting order of an Allocated Cost of Service and Rate Design filing.
- The completion of the north section of the 16-inch pipeline and the consequent rate impact.

Forecast Results

Electric Utility

The nominal (includes inflation) electric rates are projected to be higher at the end of the ten-year period as compared to last year's forecast. This is largely due to the QF estimated expenditures and timing, which now are expected to grow to an $89 million per year level by 1996. This compares with $69 million per year in 1995 in last year's forecast.

The overall real (without inflation) rate increases over the ten-year period is approximately two percent on a compound annual basis.

Natural Gas Utility

Both the real and nominal natural gas rate forecasts for the Firm and Utility classes are higher than last year. A large part is due to a greater increase in the current natural gas supply costs projections which are estimated to begin in the 1990 time frame. However, the real natural gas rates are still projected to decline over the ten-year period at an overall rate of approximately one percent.

Any questions which you may have or further explanation you might require should be directed to Mr. Mike Panisko 723-5421, extension 2445, in our Butte offices.

Very truly yours,

Stephen Winter

Stephen L. Winter
General Manager
Revenue Requirements

SLW/MP/ka

Enclosures

cc: Montana Consumer Counsel
Northwest Power Planning Council

330681

PART I

THE MONTANA POWER COMPANY

ELECTRICITY RATE FORECAST

1987-1996

ELECTRIC FORECASTING METHODOLOGY
1987 FORECAST

The 1987 electric rate forecast presented here reflects The Montana Power Company's (MPC) annual rate projections for the next ten years. These projections are based on a regulated test year concept to arrive at annual revenue requirements. Regulated test year revenues are projected for each of the ten years.

These revenue requirements are allocated to the various classes based on the marginal costing methodology ordered in the MPSC Order No. 5051d-i, Docket No. 83.9.67. For each of the ten years in the forecast period, an average cents/kWh by class was derived by dividing projected loads into the class revenues. The percent changes in average cents/kWh from the model were then applied to the average annual cents/kWh from the existing rate schedules to arrive at the annual rate forecast for each consumption level presented.

MPSC Order No. 5113b, Dockets No. 84.11.71, No. 84.10.64 and No. 83.9.67 allowed for the implementation of a Rate Moderation Plan (RMP) which, over approximately eight years, phases in the impacts of Order No. 5113b and schedules annual rate increases/decreases starting on August 29, 1985. The rates currently in effect are at the second year of the RMP. The next three increases are scheduled to be followed by three decreases and have been incorporated into this forecast.

As noted last year, due to the Avoided Cost (Small Power Production and Cogeneration) Docket No. 84.10.64 and subsequent Order No. 5091c, MPC will file a Qualifying Facility Cost (QF) tracking mechanism to recover expenditures for purchases from small power production and cogenerators. Effects of this mechanism have also been incorporated into this forecast.

It should be noted at the time which this forecast is to be issued, MPC expects to submit a rate design and cost of service filing. This forecast projects changes in rates following the current rate case filing guidelines and methodology. It does not attempt to forecast rate structure changes which may occur as a result of eventual Public Service Commission action.

Within the Rate Strategy Model (RSM), the following assumptions were utilized:

1. Rate adjustments to reflect increased costs occur on a timely basis, but cognizant of MPC's commitment to rate stability;

2. Qualifying Facility expense projections (the handling of the cost tracking mechanism and the normalizing of the ten-year projections) reflect MPC's best estimate at the time of the preparation of this forecast;

3. Off-system sales achieve the levels projected by the Company;

4. A rate of return on rate base of 10.53 percent was held constant throughout the ten-year period;

5. Montana jurisdictional customer revenue reflects the effects of credits from off-system sales, U.S. Indian Irrigation Service and Rural Electric Cooperatives (REC). The annual REC phase-in plan (FERC Docket No. ER84-359-002) is integrated into the projections on an annual basis;

6. The inflation forecasts used to derive real dollar values were obtained from the Data Resources, Inc., macroeconomic model. It should be noted that the index year has changed from 1972 to 1982 (i.e., 1982 dollars). The Implicit Price Deflator for Personal Consumption was used as the inflation index for the Residential class while the Producer Price Index for Finished Goods was used for the General Service class and Industrial Contract.

It should be noted that any changes in the assumed circumstances will necessarily affect the forecasted electric rates presented here.

In addition to the above assumptions, the 1987 and 1988 projected rates reflect the following conditions:

<u>1987</u>

1. Docket No. 86.8.41, Order No. 5218 rates were in effect the first eight months.

2. An estimate of the second step of the RMP at approximately 8.6 percent and an estimate of the initial QF cost tracking mechanism increase of .3 percent for the next four months.

<u>1988</u>

1. The projected December 1987 level was maintained for the first three months.

2. An estimate of the second cogeneration tracking mechanism increase of 4.5 percent for the next five months.

3. An estimate of the third step of the RMP at approximately 10.0 percent for the next four months.

The consumption levels for which the forecasts are made within each of the classes are the same as last year's forecast.

Tables 1 through 3 show the numeric results while the graphical representation of both the nominal and real rates are presented in Figures 1 through 4.

In 1988 and 1989, the annual percent increases of approximately 13 percent and 16 percent, respectively, are greater than the Rate Moderation Plan increases of ten percent and 9.6 percent largely due to the impact of projected cogeneration and small power production expenditures.

The nominal rates in cents/kWh for each class display two increasing periods. The first period represents both the remaining increases of the RMP and the initial effects of the QF cost tracking mechanism. The second period, starting in 1993, reflects the second major increase in QF expenditures from a base of $33 million to $62 million in one year. The total effect for the ten-year period is an average annual increase of approximately seven percent.

The <u>real</u> rates in cents/kWh for each class show two upward cycles. As would be expected, the first cycle is through 1990 and the second occurs in 1993-1994. Over the ten-year period, for all classes, the <u>real</u> electric rate is expected to increase at an average annual rate of two percent. This is just slightly higher than what was projected in last year's forecast.

330562

TABLE 1
THE MONTANA POWER COMPANY
1987 ELECTRICITY RATE FORECAST
RESIDENTIAL CLASS CENTS/KWH
1987 - 1996

	6,000 KWH ANNUAL CONSUMPTION[1]			9,360 KWH ANNUAL CONSUMPTION[1]			18,000 KWH ANNUAL CONSUMPTION[1]		
YEAR	REAL[2]	NOMINAL	% CHANGE[3]	REAL[2]	NOMINAL	% CHANGE[3]	REAL[2]	NOMINAL	% CHANGE[3]
1986	4.32	4.84	-	4.16	4.65	-	4.12	4.60	-
1987	4.50	5.21	7.8	4.33	5.01	7.8	4.29	4.96	7.8
1988	4.88	5.88	12.8	4.69	5.65	12.8	4.63	5.58	12.5
1989	5.42	6.82	16.0	5.21	6.55	16.0	5.16	6.49	16.2
1990	5.65	7.39	8.5	5.43	7.11	8.5	5.37	7.03	8.5
1991	5.49	7.50	1.4	5.27	7.21	1.4	5.22	7.13	1.4
1992	5.28	7.57	0.9	5.08	7.27	0.9	5.02	7.20	0.9
1993	5.46	8.21	8.5	5.25	7.90	8.5	5.19	7.81	8.5
1994	5.47	8.68	5.6	5.26	8.34	5.6	5.20	8.25	5.6
1995	5.41	9.07	4.5	5.20	8.72	4.5	5.14	8.62	4.5
1996	5.31	9.42	3.9	5.11	9.06	3.9	5.05	8.96	3.9

---

1 The monthly consumption levels were approximated based on a load research study performed with 1981 data.

2 Prior issues had been based on 1972 dollars. Within this current forecast "Real" refers to the rates being stated in 1982 dollars. That is, general inflation has been removed and 1982 is the base year of the index (i.e., 1982 = 1.00). The Implicit Price Deflator for personal consumption was used. The index forecasts were obtained from Data Resources, Inc.'s "U.S. Long-Term Review, Winter 1986-87."

3 The "% Change" column refers to the year-to-year change in nominal rates.

TABLE 2
THE MONTANA POWER COMPANY
1987 ELECTRICITY RATE FORECAST
GENERAL SERVICE CLASS - CENTS/KWH
1987 - 1996

ANNUAL CONSUMPTION OF 28,800 KWH				ANNUAL CONSUMPTION OF 27.6 MILLION KWH			
YEAR	REAL[1]	NOMINAL	% CHANGE[2]	YEAR	REAL[1]	NOMINAL	% CHANGE[2]
1986	4.38	4.52	-	1986	3.35	3.46	-
1987	4.60	4.87	7.7	1987	3.51	3.72	7.7
1988	4.99	5.50	13.0	1988	3.81	4.20	12.9
1989	5.59	6.40	16.4	1989	4.23	4.84	15.3
1990	5.82	6.94	8.3	1990	4.42	5.27	8.8
1991	5.65	7.03	1.3	1991	4.30	5.35	1.6
1992	5.43	7.07	0.6	1992	4.18	5.44	1.7
1993	5.60	7.65	8.2	1993	4.36	5.95	9.3
1994	5.60	8.08	5.6	1994	4.38	6.31	6.1
1995	5.51	8.42	4.2	1995	4.35	6.65	5.3
1996	5.40	8.74	3.8	1996	4.31	6.99	5.1

1 Prior issues had been based on 1972 dollars. Within the current forecast "Real" refers to the rates being stated in 1982 dollars. That is, general inflation has been removed and 1982 is the base year of the index (i.e., 1982 = 1.00). The Producer Price Index for finished goods was used. The index forecasts were obtained from Data Resources, Inc.'s "U.S. Long-Term Review, Winter 1986-87."

2 The "% Change" column refers to the year-to-year change in nominal rates.

TABLE 3
THE MONTANA POWER COMPANY
1987 ELECTRICITY RATE FORECAST
INDUSTRIAL CONTRACT - CENTS/KWH
1987 - 1996

ANNUAL CONSUMPTION OF 56.4 Million KWH				ANNUAL CONSUMPTION OF 402 MILLION KWH			
YEAR	REAL[1]	NOMINAL	% CHANGE[2]	YEAR	REAL[1]	NOMINAL	% CHANGE[2]
1986	2.81	2.90	-	1986	2.67	2.76	-
1987	2.95	3.13	7.7	1987	2.81	2.97	7.7
1988	3.21	3.53	12.9	1988	3.05	3.36	12.9
1989	3.58	4.10	16.1	1989	3.40	3.89	16.1
1990	3.73	4.44	8.4	1990	3.54	4.22	8.4
1991	3.62	4.50	1.4	1991	3.44	4.28	1.4
1992	3.49	4.54	0.9	1992	3.32	4.32	0.9
1993	3.61	4.93	8.6	1993	3.43	4.69	8.6
1994	3.61	5.21	5.6	1994	3.44	4.95	5.6
1995	3.56	5.44	4.4	1995	3.39	5.17	4.4
1996	3.54	5.73	5.2	1996	3.36	5.44	5.2

[1] Prior issues had been based on 1972 dollars. Within this current forecast "Real" refers to the rates being stated in 1982 dollars. That is, general inflation has been removed and 1982 is the base year of the index (i.e., 1982 = 1.00). The Producer Price Index for finished goods was used. The index forecasts were obtained from Data Resources, Inc.'s "U. S. Long-term Review, Winter 1986-87."

[2] The "% Change" column refers to the year-to-year change in nominal rates.

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FIGURE 1
THE MONTANA POWER COMPANY
RESIDENTIAL ELECTRICITY RATES
1986 – 1996

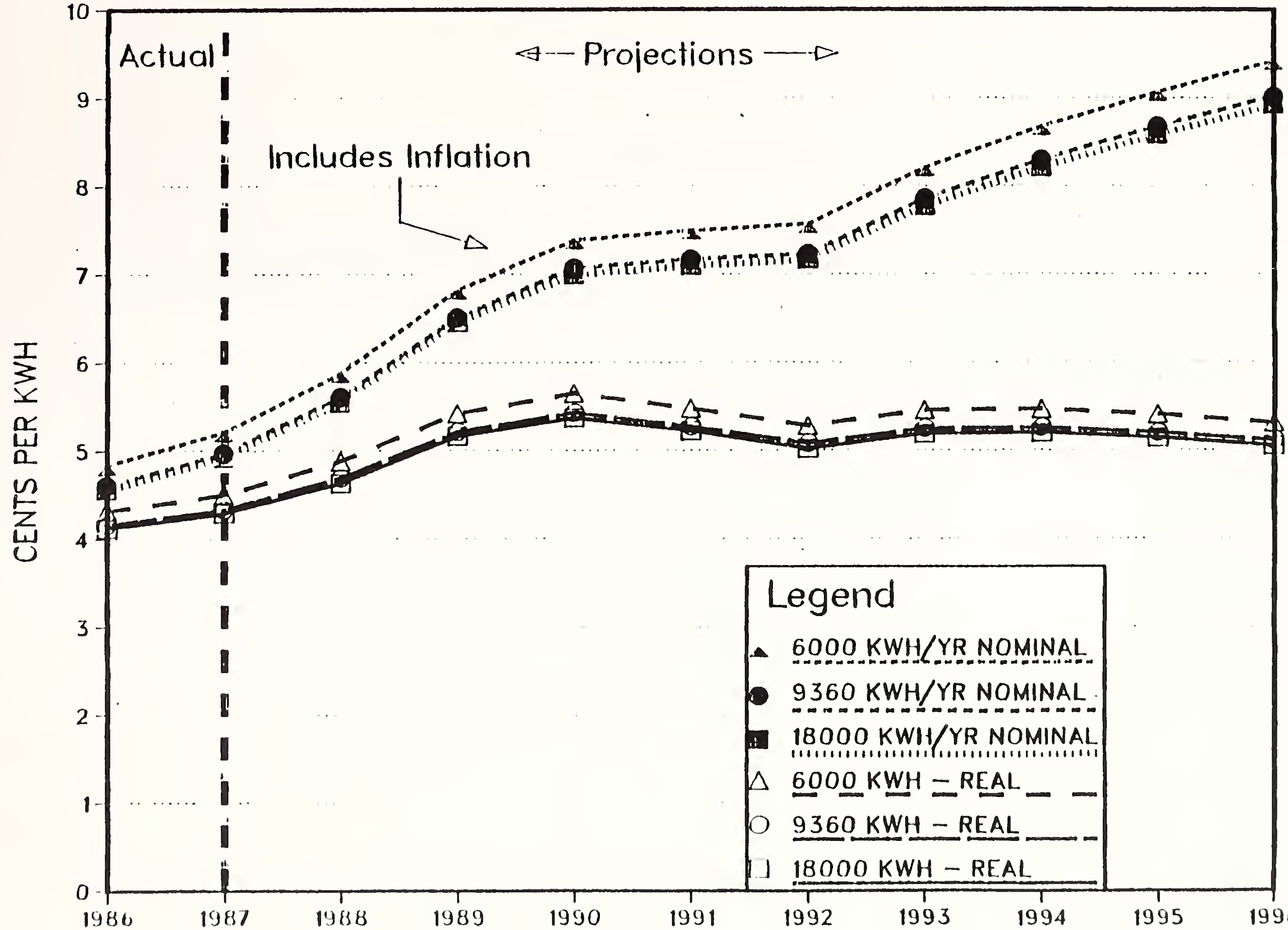


FIGURE 2
THE MONTANA POWER COMPANY
GENERAL SERVICE ELECTRICITY RATES – 28800 KWH
1986 – 1996

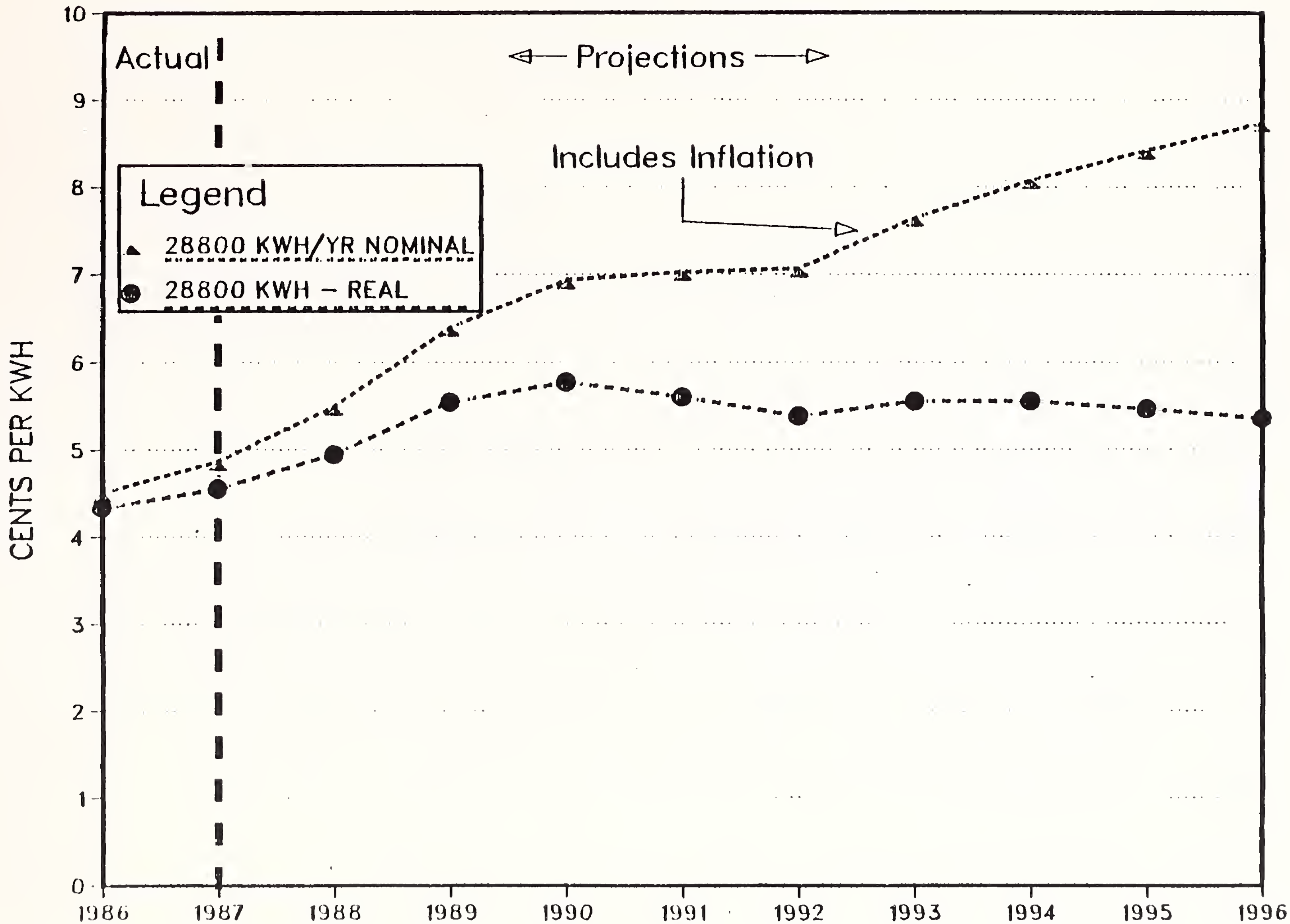


FIGURE 3
THE MONTANA POWER COMPANY
GENERAL SERVICE ELECTRICITY RATES – 27.6MILLION KWH
1986 – 1996

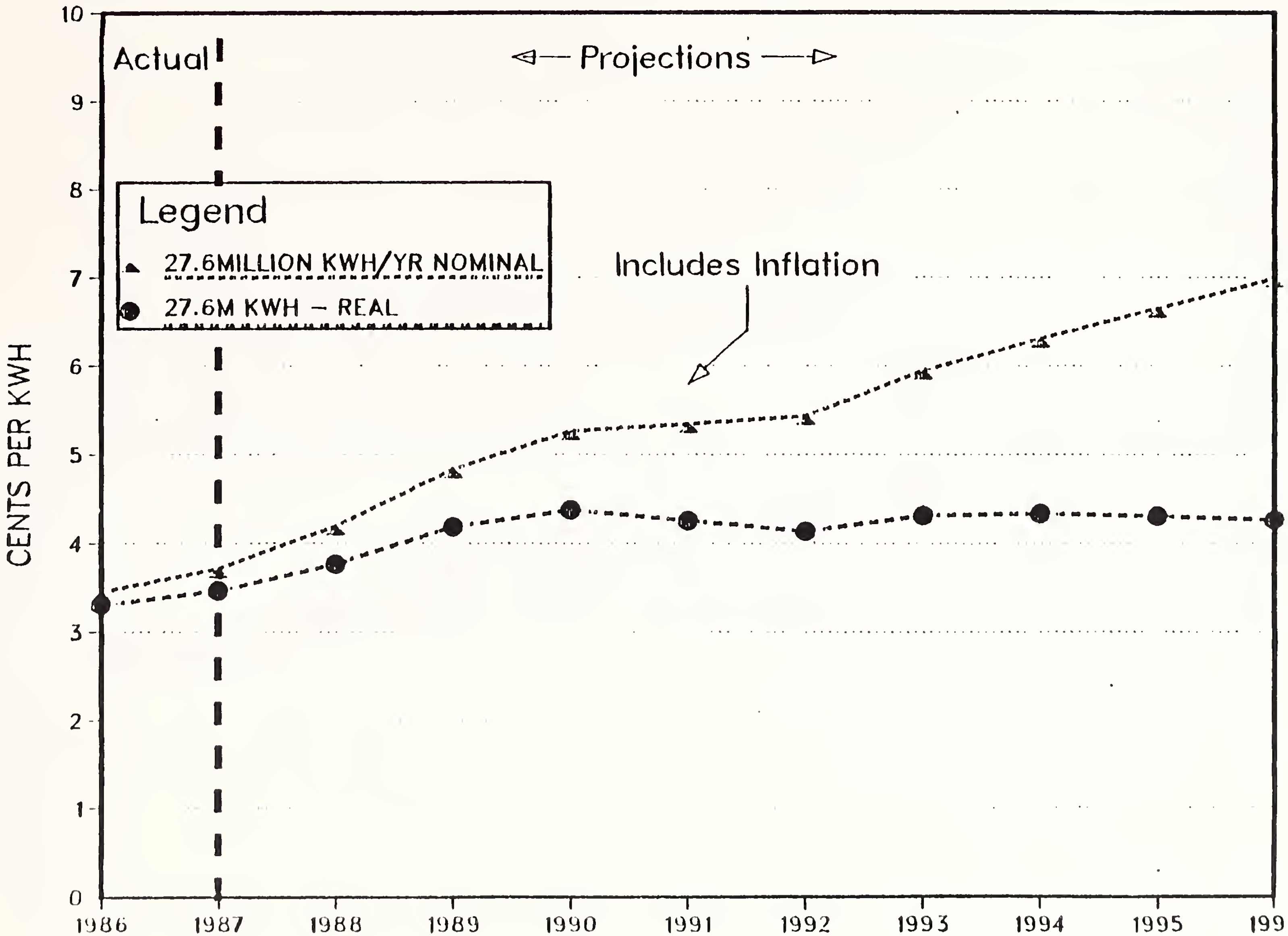
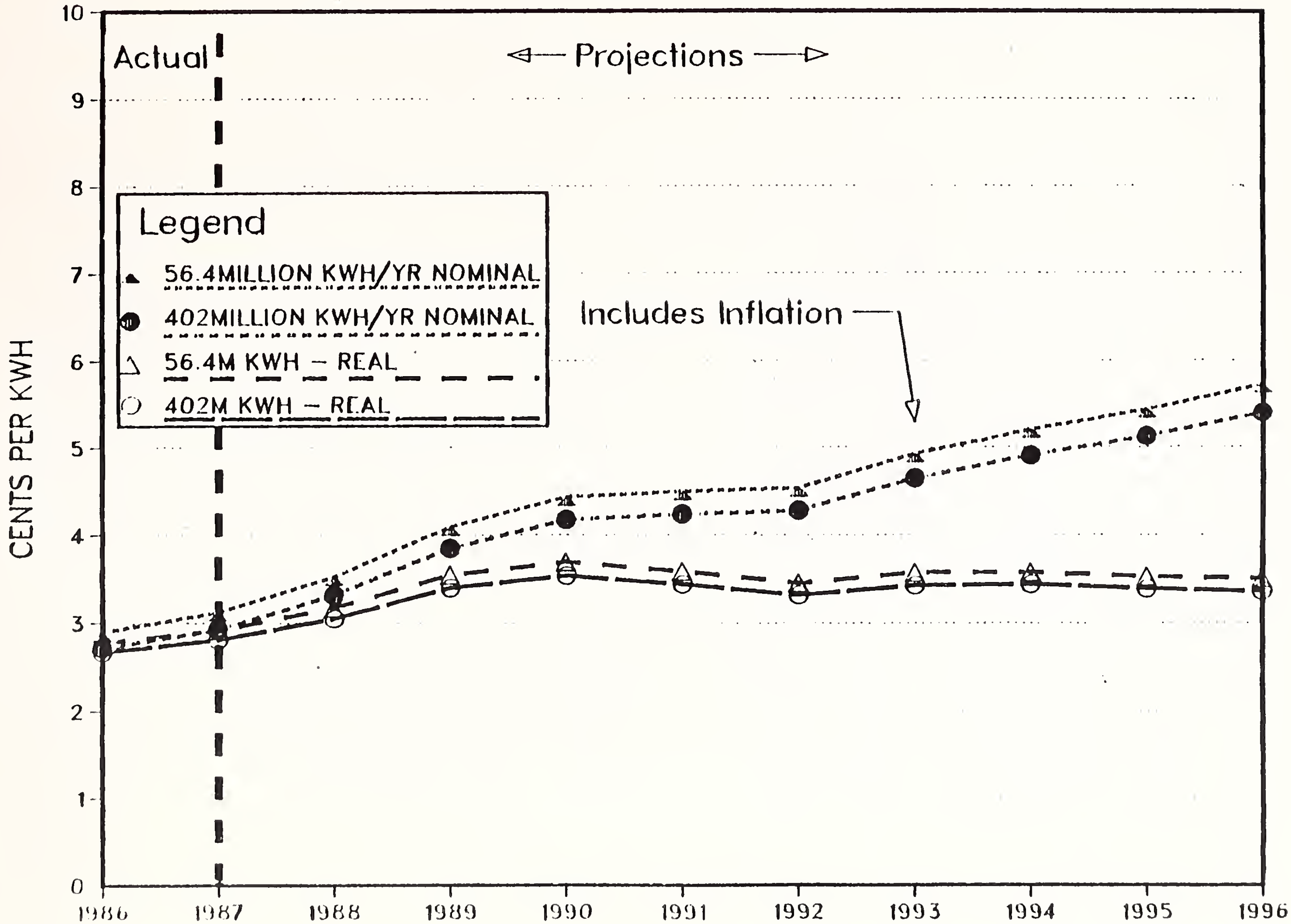


FIGURE 4
THE MONTANA POWER COMPANY
INDUSTRIAL CONTRACT ELECTRICITY RATES
1986 – 1996



PART II

THE MONTANA POWER COMPANY

NATURAL GAS RATE FORECAST

1987-1996

Natural Gas Forecast Methodology

1987 Forecast

The annual natural gas rate forecast reflects The Montana Power Company's (MPC) most recent projections for the next ten years. This forecast is based on a regulated test year concept to arrive at an annual revenue requirement. This revenue is then allocated to both the Firm class and Utility class based on an equal apportionment of gas costs. Within the nongas supply cost allocation, distribution and customer costs are not allocated to the Utility class.

Again, as has been the case in the last four MPC natural gas rate forecasts, even with the current inflation projections by DRI over the ten-year period at approximately the four percent level, the <u>real</u> natural gas rate is still expected to decrease over the next ten years (refer to Table 4 and Figures 5 and 6).

As stated in the electric section, following the issuance of this forecast, MPC expects to submit a rate design and cost of service filing. This forecast projects changes in rates following the current rate case filing guidelines and methodology. It does not attempt to forecast rate structure changes which may occur as a result of the eventual Public Service Commission action on the rate design filing.

Major assumptions are:

1. The information from the Show Cause filing dated February 2, 1987 (Ref. Docket No. 86.11.62, Sub. 10, Order No. 5236), is reflected within the Rate Strategy Model (RSM).

2. The northern portion for the 16-inch pipeline is estimated to be in plant-in-service in late 1987*.

3. The compressors for the 16-inch pipeline are estimated to be in plant-in-service in late 1988*.

4. The rate of return on rate base of 10.34 percent is held constant throughout the ten-year period.

5. The current downward trend of gas supply costs is expected to "bottom out" in the 1989 time frame at

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* At the time of the issuance of this forecast, changes in the timing of the Northern portion of the 16-inch pipeline and the compressors were being made and the scheduled completion was uncertain.

$1.43/Mcf and then grow to approximately $2.43/Mcf by 1996.

6. The ten-year projection of the Montana gas market is projected to grow slightly to approximately 27,439 Mmcf from the 1987 projection of 26,261 Mmcf.

7. The rates are shown <u>without</u> the effects of the deferred revenue credit in the tariff Supplement No. 8 (Docket No. 86.8.41, Order No. 5218), the Industrial Market Retention (IMR) Rate, and the Natural Gas Incentive (NGI) Rate.

However, it must be understood that any changes in the assumptions listed above, especially in those having a major impact, will necessarily affect the accuracy of this natural gas rate forecast.

U.S. and Canadian government pricing actions continue to cause uncertainty in this forecast. The world oil situation remains unstable and its impact uncertain as the gas bubble begins to shrink.

The inflation forecasts used to derive real dollar values were obtained from Data Resources, Inc. (winter 1986-1987) macroeconomic model. The Implicit Price Deflator for Personal Consumption was used for the Firm class, while the Producer Price Index for Finished Goods was used for the Utility class.

The <u>real</u> and nominal natural gas rate forecasts for the Firm and Utility classes shown on Table 4 are slightly higher at the end of the ten-year period than last year. However, the nominal rate projections through 1990 are considerably lower than last year largely due to the lower rate based amount for the Southern portion of 16-inch pipeline. After 1990, these rates are expected to increase at a greater yearly level due to the steeper increase in the current gas supply cost projections.

The nominal prices for both the Firm and Utility classes are anticipated to grow at slightly under a four percent annual rate (3.9% and 3.7%, respectively). An average annual <u>decrease</u> in real rates over this same period at just under one percent is currently forecasted for both the Firm and Utility classes.

Due to the fact that the current tariff for the Firm class has evolved to a flat rate, where previously it had been a two-step rate, the three consumption levels shown in last year's forecast do not appear in this issue.

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April 1987

TABLE 4
THE MONTANA POWER COMPANY
1987 NATURAL GAS RATE FORECAST
1987-1996

	FIRM[1]			UTILITY[1]		
YEAR	REAL[2]	NOMINAL	% CHANGE[3]	REAL[2]	NOMINAL	% CHANGE[3]
1986	3.33	3.73[4]	-	3.63	3.76[4]	-
1987	2.99	3.47[5]	-7.0	3.28	3.47[5]	-7.5
1988	3.14	3.78	9.2	3.35	3.68	6.1
1989	3.11	3.91	3.3	3.30	3.78	2.5
1990	3.17	4.15	6.3	3.38	4.03	6.8
1991	3.21	4.39	5.7	3.43	4.28	6.1
1992	3.18	4.55	3.7	3.41	4.44	3.9
1993	3.16	4.76	4.5	3.41	4.65	4.7
1994	3.14	4.97	4.5	3.38	4.88	4.8
1995	3.11	5.21	4.7	3.35	5.12	4.9
1996	3.07	5.45	4.7	3.31	5.37	4.9

1 All rates are in $/Mcf. The Firm class is based on a 12.94 psia, while the Utility class is based on a 14.9 psia.

2 Prior issues had been based on 1972 dollars. Within this current forecast, "Real" refers to the rates being stated in terms of 1982 dollars. That is, general inflation has been removed and 1982 is the base year of the index (i.e., 1982 = 1.00). The Implicit Price Deflator for Personal Consumption was used as the index for the Firm class while the Producer Price Index for Finished Goods was used for the Utility class. The forecasts for both indices were obtained from Data Resources, Inc.'s "U.S. Long-Term Review, Winter 1986-1987."

3 The "% Change" column refers to the year-to-year change in the nominal rates.

FIGURE 5
THE MONTANA POWER COMPANY
FIRM NATURAL GAS RATES
1986 – 1996

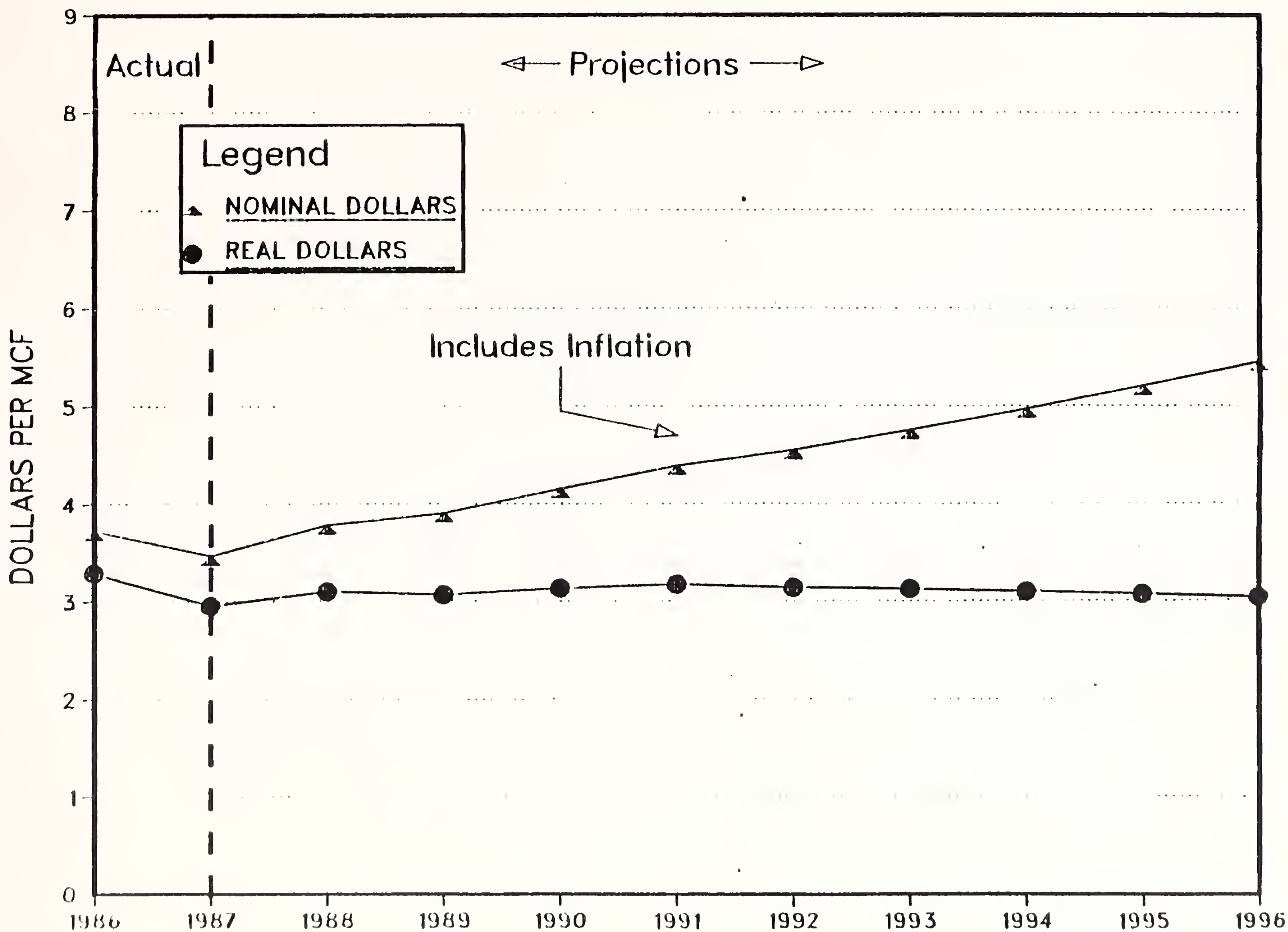
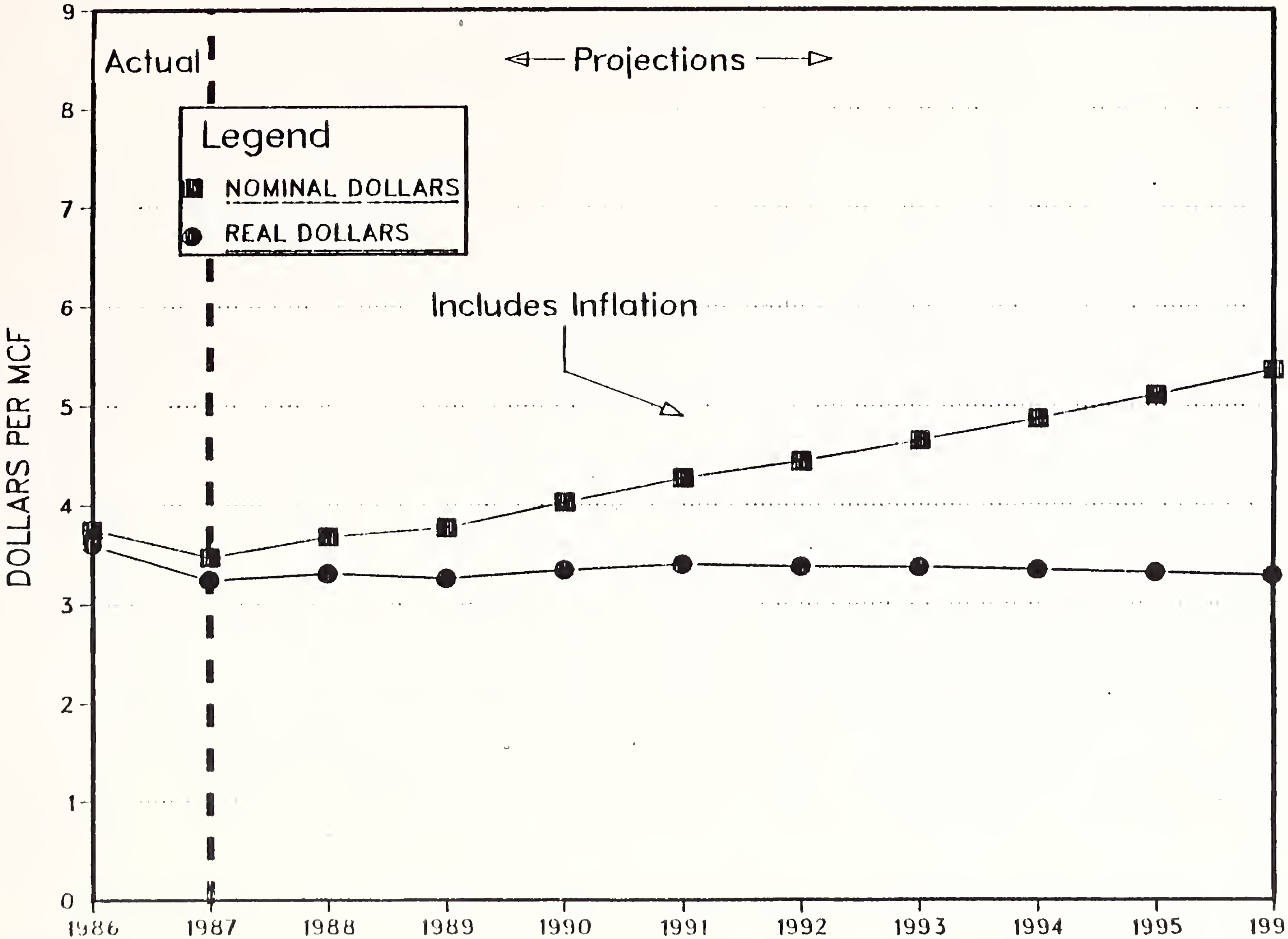


FIGURE 6
THE MONTANA POWER COMPANY
UTILITY NATURAL GAS RATES
1986 – 1996



Public Service Commission of Montana

Schedule IIGC

Supplement #8

Form 400-B

Public Service Commission of Montana

THE MONTANA POWER COMPANY

(Name of Company)

Sheet No. IIGC-82 Supp. #8

Cancelling Sheet No. IIGC-82 Supp. #7

Schedule IIGC-82 Supplement #8

Interruptible Industrial Gas Contract Service

AVAILABLE FOR: Interruptible Industrial Contract Gas Service under the terms of contract agreements between the Company and the industrial users of more than 60,000 Mcf per contract year/5000 Mcf per month.

MONTHLY RATE PER 14.9 PSIA Mcf: Total Rate (comprised of Fixed and Variable Energy Rates as defined herein) is:

TOTAL RATE

All Mcf @ $3.870 per Mcf

The above rate is comprised of a "Variable Energy Rate" component which the Company may, with the concurrence of the Commission, periodically increase or decrease to reflect increases or decreases in the Company's cost of gas as such cost of gas is reported periodically to the Commission. The "Variable Energy Rate" component is currently:

$1.332 per Mcf

and a "Fixed Energy Rate" component derived by deducting the current "Variable Energy Rate" component as periodically reported, from the "Total Rate," as adjusted.

The "Total Rate" shall be adjusted to reflect changes in the "Variable Energy Rate" component as provided herein and in the respective contracts.

The phrase "Cost of Gas" includes the Company's cost of purchased gas and royalty expense on produced gas, from all sources, net of storage costs.

DEFERRED GAS COST: In accordance with the Deferred Accounting Gas Rate Schedule, the rate(s) above include the following unit amortization amounts:

~~1. MPSC Order No. 4775a ($0.100)/Mcf~~
Extinguished January 31, 1983
~~2. MPSC Order No. 4976 $0.181/Mcf~~
Extinguished January 1, 1984
~~3. MPSC Order No. 5116 ($0.116)/Mcf~~
Extinguished January 1, 1986
~~4. MPSC Order No. 5174 ($0.219)/Mcf~~
Extinguished January 1, 1987
5. MPSC Order No. 5245 ($0.164)/Mcf

Issued ______ (Date) By [signature] (Signature of Officer of Utility)

Approved December 22, 1986 (Date) Effective for meter readings on and after January 1, 1987 (Date)

Dkt. No. 86.12.68, Interim Order #5245
(Space for Stamp or Seal of Commission)

PUBLIC SERVICE COMMISSION OF MONTANA

[signature]
Secretary.

*Space below these lines for use of Commission only.

Form 403-B

Public Service Commission of Montana

THE MONTANA POWER COMPANY

(Name of Company)

Sheet No. IIGC-82 Supp. #8

Cancelling Sheet No. IIGC-82 Supp. #7

Schedule IIGC-82 Supplement #8

Interruptible Industrial Gas Contract Service

INDUSTRIAL MARKET RETENTION RECOVERY: In accordance with MPSC Order No. 5245, the rate(s) above include the following unit amortization amount to be collected until the balance is extinguished: $0.032/Mcf.

Issued ________ (Date)

By Stephen Wait (Signature of Officer of Utility)

Approved December 22, 1986 (Date)

Effective for meter readings on and after January 1, 1987 (Date)

Dkt. No. 86.12.68, Interim Order #5245

(Space for Stamp or Seal of Commission)

PUBLIC SERVICE COMMISSION OF MONTANA

Secretary.

*Space below these lines for use of Commission only.